CLAIMS

1. An information recording medium comprising a recording portion capable of storing information three-dimensionally,

wherein the recording portion includes at least one recording layer, and

the recording layer contains titanium oxide.

2. The information recording medium according to claim 1, wherein the titanium oxide is at least one kind of an amorphous form and a crystal form, and the crystal form is at least one kind selected from the group consisting of an anatase type, a brookite type, and a rutile type.

3. The information recording medium according to claim 1, wherein the titanium oxide is at least one kind selected from the group consisting of an anatase type and a brookite type.

4. The information recording medium according to claim 1, wherein the recording layer is substantially made of titanium oxide.

5. The information recording medium according to claim 1, wherein the recording layer contains the titanium oxide and a low refractive-index material having a refractive index smaller than that of the titanium oxide.

6. The information recording medium according to claim 5, wherein the recording layer contains 5wt% to less than 100wt% of the titanium oxide.

7. The information recording medium according to claim 5, wherein the titanium oxide is in a particle form, and an average particle size of the titanium oxide is shorter than a wavelength of recording light and a wavelength of reproducing light.

8. The information recording medium according to claim 7, wherein an average particle size of the titanium oxide is shorter than 1/4 of the wavelength of the recording light and the wavelength of the reproducing light.

9. The information recording medium according to claim 5, wherein the low refractive-index material is resin.

10. The information recording medium according to claim 5, wherein the low refractive-index material is an inorganic material.

11. The information recording medium according to claim 1, comprising a plurality of the recording layers, wherein the recording portion further includes a plurality of intermediate layers that are substantially transparent to recording light and reproducing light, and the recording layers and the intermediate layers are stacked alternately.

12. The information recording medium according to claim 1, further comprising a protective layer substantially transparent to recording light and reproducing light, wherein the protective layer is placed on a light incident side of the recording portion.

13. The information recording medium according to claim 5, further comprising a protective layer substantially transparent to recording light and reproducing light, wherein the protective layer is placed on a light incident side of the recording portion, and made of the same material as that for the low refractive-index material.

14. The information recording medium according to claim 11, wherein the recording layer contains the titanium oxide, and a low refractive-index material having a refractive index smaller than that of the titanium oxide, and the intermediate layer is made of the same material as that for the low refractive-index material.

15. The information recording medium according to claim 1, wherein information is recorded in a part of the recording layer, and assuming that a wavelength of reproducing light for reproducing the information is λ, a refractive index of a portion of the recording layer where the information is recorded is n', and a refractive index of a portion of the recording layer where the information is not recorded is n, a thickness L of the recording layer satisfies relationships: $\lambda/(2n) < L < 3\lambda/(4n')$, or $\lambda/n < L < 5\lambda/(4n')$.

16. A method for producing an information recording medium including a recording portion capable of storing information three-dimensionally, the recording portion including at least one recording layer, and the recording layer containing titanium oxide, the method comprising the step of

forming the recording layer by coating of a coating solution containing titanium oxide.

17. The method for producing an information recording medium according to claim 16, further comprising the step of forming an intermediate layer by coating of a coating solution made of a material substantially transparent to recording light and reproducing light,

wherein the step of forming the recording layer and the step of forming the intermediate layer are repeated alternately in a predetermined order by a predetermined number.

18. An optical information recording and reproducing apparatus for recording and reproducing information with respect to an information recording medium including a recording portion capable of storing information three-dimensionally, the recording portion including at least one recording layer, and the recording layer containing titanium oxide, the apparatus comprising:

a light source for emitting recording light;

a light source for emitting reproducing light;

an objective lens for condensing light emitted from the light source for emitting the recording light and the light source for emitting the reproducing light onto the information recording medium; and

a photodetector for detecting light reflected from the information recording medium,

wherein information is recorded in the recording portion using a change in optical constant of the titanium oxide caused by a change in configuration of the titanium oxide, and the information is reproduced using the change in optical constant of the titanium oxide.

19. The optical information recording and reproducing apparatus according to claim 18, wherein the light source for emitting the recording light is a pulse laser light source, and a pulse width is 1 picosecond to 5 nanoseconds.

20. The optical information recording and reproducing apparatus according to claim 18, wherein a peak power of the light source for emitting the recording light is 2W to 300 W.

21. The optical information recording and reproducing apparatus according to claim 18, wherein an information bit is formed in the recording portion of the information recording medium using a non-linear absorption phenomenon.

22. The optical information recording and reproducing apparatus according to claim 21, wherein the non-linear phenomenon includes two-photon absorption or multi-photon absorption.

23. The optical information recording and reproducing apparatus according to claim 18, wherein an information bit is recorded three-dimensionally in the recording portion of the information recording medium, in such an order not passing through an information bit recorded in the recording portion.

24. The optical information recording and reproducing apparatus according to claim 23, wherein an information bit is recorded successively from a position farther away from an objective lens in the recording portion to a position close to the objective lens.

25. The optical information recording and reproducing apparatus according to claim 18, wherein the light source for emitting the recording light and the light source for emitting the reproducing light are the same.

26. The optical information recording and reproducing apparatus according to claim 18, wherein a wavelength of the light source for emitting the reproducing light is 0.388 μm to 0.413 μm.

27. The optical information recording and reproducing apparatus according to claim 18, wherein the change in configuration of the titanium oxide is a change from an anatase type or a brookite type to a rutile type.

28. The optical information recording and reproducing apparatus according to claim 18, wherein the change in configuration of the titanium oxide is a

change from an amorphous type to an anatase type, a brookite type, or a rutile type.